

the XRT + C-NAM arm, nausea and vomiting were the most frequent side effects reported by rates of %50 and %24, respectively. Six weeks following completion of treatment, the improvements of performance status and pulmonary symptoms were significantly higher in XRT + C-NAM arm ($p = 0.001$ and $p = 0.019$). There was no difference in late toxicities between two arms in a median following time of 7.8 month ($p = 0.606$). Loco-regional control rate was significantly higher in XRT + C-NAM arm ($p = 0.003$).

Conclusion: Using carbogen and nicotinamide as a radiosensitizer in locally advanced NSCLC seems to be safe treatment with manageable toxicities. Preliminary tumour control rates are encouraging and clinical testing will be continued.

448

POSTER

Total body irradiation in the treatment of myeloma by autologous bone marrow transplantation (ABMT)

P. Maingon¹, A. D'Hombres¹, D. Caillot², R.O. Casasnovas², J.C. Horiot¹.
¹Centre G-F Leclerc; ²C.H.U. Dijon, 21034 Dijon, France

To evaluate the toxicity and the contribution of TBI and high dose Melphalan as conditioning treatment for ABMT.

Methods: Twenty nine patients, mean age 55 years (41–65) with stage II (4 patients) or stage III (25 patients) multiple myeloma were treated after conventional chemotherapy with TBI followed 24 h later by melphalan (140 mg/m²). Before transplantation, 10% of the patients were in complete remission (RC), 34% in partial response (PR), 20% non responders. The prescribed dose of TBI (8 to 12 Gy, 2 fractions of 2 Gy per day at 9.8 cGy/mn dose rate), the dose to the lung (4 to 10 Gy) were adapted to the age.

Results: Median follow-up was 38 months. After transplantation, the overall response rate was 79% with 31% of CR and 45% of PR. Three toxic deaths occurred. Acute lung toxicities occurred in 30%, not correlated to dose. Late toxicity was noted in 6/26 patients (23%). Three-year actuarial survival was 72%, correlated with response to initial chemotherapy (100% in RC versus 56% in PR), response after BMT (81% in RC versus 50% in PR, $p = 0.0049$) and to delay between the diagnosis and BMT higher than 8 months (70% versus 0%, $p = 0.0093$).

Conclusions: Marrow transplantation conditioned by TBI and melphalan is: 1) a promising approach in patients under 65 years, 2) indicated early in the strategy of treatment, 3) needs to be adapted to age to minimize acute and late toxicity.

449

POSTER

Precision of fractionated stereotactic conformation radiotherapy of brain tumours

R.D. Kortmann¹, G. Becker¹, J. Perelmouter¹, M. Buchgeister², M. Bamberg¹. ¹Dept. of Radiotherapy, University of Tübingen; ²Dept. of Medical Physics, University of Tübingen, Germany

Purpose: To assess the geometric accuracy of field alignment in stereotactic conformation radiotherapy of brain tumours.

Methods: In 20 pat. the transfer of the computer assisted 3-D treatment plan to the patient was evaluated by repeated computerscans. The precision during treatment delivery was quantitatively assessed using sequential verification films. Linear discrepancies were measured between treatment plan and repeated CT scans (reproducibility of the isocentre during treatment set-up) and between 20 consecutive verification films per patient (reproducibility during treatment deliv.).

Results: For the total group of patients, the distribution of all deviations showed mean values between 0.5 mm and 1.6 mm \pm 0.7 mm–1.3 mm during treatment set-up and between 1.1 mm and 2.0 mm \pm 0.6 mm–2.0 mm during treatment delivery, resp. For all patients, deviations for the transition to the treatment machine were similar to deviations during subsequent treatment delivery, with 95% of all absolute deviations less than 4.0 mm.

Conclusions: Random fluctuations of field displacements up to 4.0 mm during treatment set-up and delivery prevail. They must be considered when prescribing the safety margins of the planned target volume and should help to determine "cut-off points" for corrective actions in stereotactic conformation radiotherapy of brain tumours.

450

POSTER

Quantitative assessment of early and late postradiation skin reactions in breast cancer patients

A. Warszawski, E.M. Röttinger, R. Vogel, N. Warszawski. Department of Radiotherapy, University of Ulm, Germany

Purpose: In dermatology high-resolution ultrasonic systems are valuable to follow up inflammatory dermatoses. 20 MHz ultrasonic imaging is investigated for quantitative assessment of early and late postradiation skin reactions.

Methods: Between April and November 1996, 96 high resolution ultrasound examinations of the skin in 29 patients treated for breast cancer were analysed. Total doses were between 46 and 60 Gy. The time interval between completion of radiotherapy and ultrasonic examination was up to 135 months. Irradiated and non-irradiated skin were compared.

Results: Changes of thickness and texture of dermis and subcutis were found. There were significant differences between irradiated and non-irradiated skin in early ($p < 0.001$) and late ($p = 0.0018$) reactions. The most pronounced dermal thickening occurred in early skin reactions. During radiation therapy corium thickness correlated with administered dose. Echogenicity of upper and lower corium decreased. In upper corium the greatest reduction of signal intensity occurred in early reactions. Early reactions of lower corium differed significantly from late reactions ($p = 0.001$). Discrepancies between visible skin reactions described by examining physicians, and ultrasonic proved changes were obvious.

Conclusion: There are specific textures of early and late postradiation skin reactions in comparison to non-irradiated skin. In contrast to physical examination, high-resolution 20 MHz ultrasound is a non-invasive and quantitative, easy reproducible method for assessing and documentation of early and late skin reaction during and after radiotherapy.

451

POSTER

Clinical experience with cross section imaging based conformal treatment planning procedures at 486 interstitial brachytherapy applications

G. Kovács, P. Kohr, D. Hebbinghaus, P. Dennert, R. Kampf, K. Eilf, B. Kimmig. CA University, Department Radiation Therapy, Germany

Purpose: Quality of a brachytherapy application depends on the choice of the target volume, on the dose distribution homogeneity and radiation injury on critical tissues.

Methods: Basic imaging method for conformal treatment planning is the cross-sectional imaging. The clinical applicability of a new type 3D planning system using CT and/or MRT-simulation or US-simulation for planning purposes was studied. The planning system developed at Kiel University differs from usual brachytherapy planning systems because of the obligatory use of cross-sectional imaging as basic imaging method for reconstruction of structures of interest. Dose distribution and normal anatomy can be visualized on each CT/MRT/US slice and on coronal-sagittal-axial- and oblique reconstructions (3D), as well as dose-volume histogram curves and special colour-coded visualization of dose homogeneity in the target can be analyzed.

Results: We observed on the base of planning procedures on 364 transrectal ultrasound (TRUS) guided prostate implants, 28 TRUS guided perineal implants with the RASHA applicator, 2 implants using surface templates as well as 92 free-hand plastic tube implants a significant input of quality in terms of the better interpretation of target delineation, delineation of critical structures as well as dose distribution.

Conclusion: Conformal brachytherapy treatment planning for interstitial brachytherapy means significant advantages for the clinical routine compared to 2D or semi-3D methods and offers new possible indications for implants.

452

POSTER

Hemoglobin levels predict local regional control after postoperative radiotherapy for advanced head and neck cancer

R. Gutterberger, J. Lutterbach, A. Roth, S. Röser, R. Schindler, M. Henke, H. Frommhold. Department of Radiotherapy, University Hospital Freiburg, FRG

Purpose: Low hemoglobin (Hb) levels are associated with poor response to primary radiotherapy. This has been established especially for squamous cell carcinomas (SCC) of the head and neck (H&N). The present study

was performed to determine whether Hb is also of prognostic importance in postoperatively irradiated patients.

Methods: Between 1970 and 1990, 486 male patients with UICC '92 stage III or IV (distant metastasis free) SCC of the H&N were irradiated to 60 Gy following radical resection. From this group selected for homogeneity patients were entered into this retrospective study if a pre-radiotherapy Hb value could be obtained ($n = 420$). Local recurrence rates stratified by tumor location, stage and Hb (rounded to integers from 11 to 16) were estimated by the Kaplan Meier method.

Results: Higher Hb levels were consistently associated with better locoregional control. This was highly significant, i.e. by stage (III/IV): oral cavity $p = 0.02$ ($p = 0.0001$), larynx ($n.s./p = 0.0001$), oropharynx ($p = 0.004/p = 0.0001$) and hypopharynx ($p = 0.0002/p = 0.0001$). In a multivariate analysis using a proportional hazards model Hb had more impact than stage, grading or clean margins.

Conclusion: Hb content can be measured effortlessly. Yet it is a most important prognostic factor for local regional tumor control in H&N cancer treated by radiotherapy. The present study shows that this also holds for postoperative irradiation of locally advanced disease.

453

POSTER

Image resolution and geometric accuracy of digital reconstructed radiographs (DRR) in conventional and helical computed tomography

J.S. Zimmermann, P. Zimmermann, G. Kovács, B. Kimmig. *Department of Radiation Therapy, University Hospital of Kiel, Germany*

Purpose: Conventional and/or Helical Computed Tomography (CT) is the basic imaging modality for virtual simulation and 3D conformal radiation therapy. In how far is the quality of the DRR's (resolution, geometric accuracy) depending on the slice parameters?

Methods: The influence of slice thickness, table speed and increment on resolution and geometric accuracy of the DRR's was studied at a SOMATOM PLUS S using conventional and helical imaging. Spheric phantoms and patients with bronchus carcinoma, infradiaphragmatic irradiation of Hodgkin's disease with CT-angiography and interstitial brachytherapy of the floor of mouth and pelvis have been studied.

Results: Good quantitative geometric accuracy and an excellent DRR-resolution is obtained by the use of small values for slice thickness, table-speed and increment. In patient examinations, Helical CT offers excellent reduction of breath and motion artefacts. Interstitial implants are visualized in an excellent manner.

Conclusions: Helical CT is a powerful tool for virtual simulation by offering improved DRR image quality and improved geometric accuracy within a minimum of time. It is superior to conventional CT.

454

POSTER

Electron beam portal imaging for routine documentation in radiation therapy

P. Niehoff, J.S. Zimmerman, B. Kimmig. *Department of Radiotherapy; University Hospital of Kiel, Germany*

Purpose: For quality assurance in radiotherapy, portal imaging of photon beams has become a common standard. Electron beams are usually documented at the X-ray simulator, which leads to an increase in the simulators workload. The image quality and the feasibility of portal electron beam documentation with high sensitive film-foil combination was evaluated.

Methods: In 30 patients with cancer of the head&neck, thoraxwall and pelvic region treated at a Clinic 20 with electron beams from 6 to 16 MeV Photons prior to electron treatment, from the linac with the X-ray-images from the simulator.

Results: In all 30 patients, anatomic structures were visible in portal images and x-rays pictures. Identification of soft tissue structures was better in the portal imaging mode than in the X-rays. Only for small fields with no characteristic structures inside, X-ray simulation is still recommended for its better demarcation of surrounding tissues.

Conclusions: Electron portal imaging with high sensitive film-foil combination is a very powerful method in quality assurance for documentation of electron beams with various energies. The workload of the simulation staff is reduced.

455

POSTER

Postoperative radiotherapy in endometrial cancer: Analysis of 325 cases

S. Özkök, Z. Özşaran, D. Yalman, A. Ancan, A. Aras, A. Ömezoğlu, M. Esasolak, Y. Anacak, A. Haydaroglu. *Ege University Medical Faculty Dept. of Radiotherapy, İzmir, Turkey*

Purpose: In this retrospective study endometrial cancer cases who had postoperative radiotherapy were evaluated and the prognostic factors affecting disease-free and recurrence-free survival rates were assessed.

Methods: Three hundred twenty-five cases with endometrial cancer who referred to our department between January 1986 and January 1996 for postoperative radiotherapy were evaluated retrospectively to assess the prognostic factors affecting survival.

Results: The age range was between 35–83 (median 56). Histologically 83.4% were adenocarcinoma. 5.8% were adenocarcinoma with squamous component, 5.5% were clear cell carcinoma and 5.2% were serous papillary adenocarcinoma. 63.2% of the patients had Stage I, 18.2% had Stage II, 15.7% had Stage III and 2.8% had Stage IV disease. External radiotherapy was given with 1.8–2 Gy daily fractions to a total of 45–64.8 Gy (median 54 Gy) and 54.2% of the patients were applied intracavitary RT. Local recurrence, distant metastasis and grade III–IV late morbidity rates were 8%, 19.5% and 3.6% respectively. Five year overall, disease-free and recurrence-free survival rates were 79.5%, 75.2% and 93.9% respectively.

Conclusion: In univariate analysis the prognostic factors which influence disease-free survival rate were histologic type other than adenocarcinoma ($p < 0.001$), advanced stage ($p < 0.001$), high histologic grade ($p = 0.013$), myometrial invasion more than 1/2 ($p = 0.004$) and positive peritoneal cytology ($p < 0.001$). The same prognostic factors except histologic type also influence the recurrence free survival rate. In multivariate analysis the prognostic factors which influence disease-free and recurrence-free survival rates were histologic grade and histologic type respectively.

456

POSTER

Intraoperative HDR brachytherapy of Ewing's sarcoma

A. Schuck¹, Ch. Rübe¹, A. Hillmann², M. Paulussen³, H. Jürgens³, N. Willich¹. ¹Dpt. of Radiotherapy; ²Dpt. of Orthopedics; ³Dpt. of Pediatric Oncology; Muenster, Germany

Background: Non mutilating surgery for Ewing's sarcoma often has to resect the tumor with narrow margins. An additional HDR brachytherapy may improve local control.

Methods: From 4/91 to 3/95, 20 patients (mean age 18.7 y., m:f = 13:7) were treated with an additional intraoperative brachytherapy boost after preoperative radiochemotherapy. 9 tumors were located in the pelvis, 6 at the upper and 5 at the lower extremity. There were 10 Ewing's sarcomas, 5 atypical ES, 3 PNET and 2 extraosseous ES. Brachytherapy was performed using a flab technique. The applied doses were 10 to 20 Gy. Mean follow up is 24 m.

Results: No complications were noted during and after brachytherapy. On average, the duration of surgery was prolonged for 2 h 20 min. Postoperative complications were seen in 40%. 2 patients needed a surgical revision after the first operation. Postoperative chemotherapy could be continued in time, on average after 19 days. Up to now, 1 patient had a combined local and local relapse.

Conclusion: Intraoperative HDR brachytherapy seems to be a well tolerated possibility to boost the tumor bed in case of narrow resection margins.

457

POSTER

Histopathological and biochemical evaluation of wound healing following preoperative irradiation, chemo-irradiation and intra-peritoneal 5-fluorouracil (5-FU) in the rat

M.A. Kuzu¹, I. Kuzu², F.H. Akyol³, D. Uzal³, D. Orhan⁵, E. Demirpençe⁴, C. Köksoy², I.T. Kale¹. ¹Department of Surgery, Ankara Numune; ²Department of Oncology, Hospitals; ³Department of Radiation Oncology; ⁴Department of Biochemistry, University of Hacettepe; ⁵Department of Pathology, University of Ankara, Ankara, Turkey

Purpose: Neo-adjuvant chemo- and radiotherapy for colo-rectal carcinoma could affect mechanical and biochemical parameters of anastomotic healing. Therefore, the aim of this study was to investigate the effects of such protocols on colonic anastomotic healing.